

WHAT IS CLAIMED:

1. A system for monitoring the operation of a fluid nozzle comprising:
 - a fluid nozzle configured to emit a fluid according to a
 - 5 predetermined spray pattern and flow rate;
 - a vibration sensor positioned in operative association with the fluid nozzle, the vibration sensor sensing nozzle vibration in at least one direction; and
 - a controller in communication with the vibration sensor, the
 - 10 controller, based on vibrations sensed by the vibration sensor, being configured to convey information to an operator regarding the flow rate or the spray pattern of a fluid being emitted by the nozzle.
2. A system as defined in claim 1, wherein the controller is configured to compare a predetermined standard vibration output to the vibration output received from the vibration sensor, the controller being configured to indicate an irregularity in the operation of the fluid nozzle
- 5 from the comparison.
3. A system as defined in claim 1, wherein the controller comprises a display that visually displays information received from the vibration sensor for determining whether there are any irregularities in the spray pattern or flow rate of a fluid being emitted by the nozzle.
4. A system as defined in claim 1, wherein the controller comprises a microprocessor.
5. A system as defined in claim 1, wherein the controller is configured to compare the spray pattern vibration output received from the vibration sensor to a spray pattern vibration output received by the controller from a second vibration sensor placed in operative association
- 5 with a second fluid nozzle, the controller being configured to indicate an irregularity in the operation of either of the fluid nozzles from the comparison.

6. A system as defined in claim 1, wherein the vibration sensor comprises an accelerometer.
7. A system as defined in claim 1, wherein the fluid nozzle comprises a pulsating nozzle.
8. A system as defined in claim 7, wherein the controller is further configured to indicate whether the fluid nozzle is pulsating at a predetermined frequency, duty cycle, or waveform.
9. A system as defined in claim 1, wherein the fluid nozzle includes a Z axis that comprises the direction of flow of a fluid through the nozzle, an X axis that is perpendicular to the Z axis and extends to the left and right of the nozzle when facing a front of the nozzle, and a Y axis that is perpendicular to the Z axis and the X axis, the vibration sensor sensing vibrations in at least one of the Z axis direction, the X axis direction, or the Y axis direction.
- 5 10. A system as defined in claim 9, wherein the vibration sensor senses vibrations in the Z axis direction for conveying information to an operator regarding the flow rate of a fluid being emitted by the nozzle.
11. A system as defined in claim 9, wherein the vibration sensor senses vibrations in the Y axis direction for conveying information to an operator regarding the spray pattern of a fluid being emitted by the nozzle.
12. A system as defined in claim 1, wherein the vibration sensor comprises a piezoelectric device.
13. A system as defined in claim 1, wherein the controller includes a visual or audible alarm that is activated when the vibration output received from the vibration sensor is outside of preset limits.
14. An agrochemical spray system incorporating the system defined in claim 1.
15. A system as defined in claim 1, wherein the vibration

sensor is configured to sense vibrations at a frequency of from about 500 Hz to about 10,000 Hz.

16. A system as defined in claim 1, wherein the vibration sensor is configured to sense vibrations at a frequency of from about 1,000 Hz to about 8,000 Hz.

17. A system as defined in claim 1, wherein the vibration sensor is configured to sense vibrations at a frequency of from about 2,000 Hz to about 7,000 Hz.

18. A system as defined in claim 1, further comprising an amplifying device for amplifying the vibration output generated by the vibration sensor and communicated to the controller.

19. A system as defined in claim 1, further comprising a current and voltage device for measuring the electrical characteristics of a pulsating valve.

20. A system as defined in claim 1, further comprising a filtering device for filtering the vibration output generated by the vibration sensor and communicated to the controller.

21. A process for monitoring the operation of a fluid nozzle comprising:

sensing vibrations occurring at a fluid nozzle while the nozzle is emitting a fluid; and

5 comparing the sensed vibrations to a reference for determining whether the nozzle is operating properly.

22. A process as defined in claim 21, wherein the reference comprises an ideal nozzle vibration frequency pattern.

23. A process as defined in claim 21, wherein the reference comprises vibrations sensed from a second fluid nozzle.

24. A process as defined in claim 21, wherein the sensed vibrations indicate any irregularities in a spray pattern being emitted by the nozzle.

25. A process as defined in claim 21, wherein the sensed vibrations indicate whether any flow rate irregularities are occurring through the nozzle.

26. A process as defined in claim 21, wherein the vibrations are sensed by an accelerometer.

27. A process as defined in claim 21, wherein the fluid nozzle emits the fluid in pulses.

28. A process as defined in claim 21, wherein the reference comprises an initial vibration frequency pattern created by the fluid nozzle.

29. A process as defined in claim 21, wherein the fluid nozzle includes a Z axis that comprises the direction of flow of a fluid through the nozzle, an X axis that is perpendicular to the Z axis and extends to the left and right of the nozzle when facing a front of the nozzle, and a Y axis that is perpendicular to the Z axis and the X axis, and wherein vibrations are sensed in at least one of the Z axis direction, the X axis direction, or the Y axis direction.

30. A process as defined in claim 29, wherein vibrations are sensed in the Z axis direction for monitoring flow rate variations as the fluid is emitted from the nozzle.

31. A process as defined in claim 29, wherein the vibrations are sensed in the Y axis direction for monitoring any variations in a spray pattern or droplet size spectrum being emitted by the nozzle.

32. A process as defined in claim 29, wherein vibrations are sensed in at least two directions.

33. A process as defined in claim 29, wherein vibrations are sensed in the Z axis direction, the X axis direction, and the Y axis direction, the fluid nozzle emitting the fluid in pulses according to a preset duty cycle, and wherein the sensed vibrations indicate any irregularities in the duty cycle.

34. A process as defined in claim 21, wherein the vibrations are sensed by a piezoelectric device.

35. A process as defined in claim 21, wherein the fluid is emitted by the nozzle at a flow rate of from about 0.05 gals/min to about 1.5 gals/min.

36. A process as defined in claim 21, wherein vibrations are sensed at a frequency of from about 500 Hz to about 10,000 Hz.

37. A process as defined in claim 21, wherein vibrations are sensed at a frequency of from about 1,000 about 8,000 Hz.

38. A process as defined in claim 21, wherein vibrations are sensed at a frequency of from about 2,000 Hz to about 7,000 Hz.

39. A process as defined in claim 21, wherein the fluid nozzle emits the fluid in a fan-shaped pattern.

40. A process as defined in claim 21, wherein the fluid nozzle emits the fluid in a cone-shaped pattern.

41. An agrochemical delivery system for dispensing controlled amounts of a fertilizer or pesticide onto a crop comprising:

a reservoir for holding an agrochemical, said reservoir including an outlet for dispensing said agrochemical;

5 a pumping means for moving the agrochemical;

a distribution manifold in communication with the outlet of the reservoir, the distribution manifold being connected to a plurality of dispensing tubes;

a plurality of fluid nozzles, each nozzle being placed on the
10 end of a corresponding dispensing tube for dispensing an agrochemical onto a crop, each nozzle including a Z axis that comprises the direction of flow of an agrochemical through the nozzle, a Y axis that is perpendicular to the Z axis and parallel to a direction of travel of the agrochemical delivery system when the system is dispensing an
15 agrochemical, and an X axis that is perpendicular to the Z axis and

perpendicular to the Y axis;

5 a plurality of vibration sensors positioned in operative association with selected fluid nozzles, the vibration sensors sensing nozzle vibration in at least one direction, the at least one direction comprising the Z axis direction, the Y axis direction, or the X axis direction; and

10 a controller in communication with each of the vibration sensors for receiving a vibration output from each of the sensors, the controller being configured to compare the vibration outputs to a reference for determining whether the corresponding nozzles are operating properly.

42. A system as defined in claim 41, wherein the controller comprises a microprocessor.

43. A system as defined in claim 41, wherein the controller comprises a plurality of microprocessors.

44. A system as defined in claim 41, wherein the controller comprises a display that visually displays information received from the vibration sensors for determining whether there are any irregularities in the spray pattern or flow rate of an agrochemical being emitted by one of
5 the nozzles.

45. A system as defined in claim 41, further comprising an alarm that is activated when the information received from the vibration sensors is outside of preset limits.

46. A system as defined in claim 41, wherein the reference comprises an ideal nozzle vibration frequency pattern.

47. A system as defined in claim 41, wherein the reference comprises an average of the vibration outputs received from the vibration sensors.

48. A system as defined in claim 41, wherein the reference comprises an initial vibration frequency pattern created by averaging the

vibration outputs initially received from each of the vibration sensors.

49. A system as defined in claim 41, wherein the vibration sensors comprise accelerometers.

50. A system as defined in claim 41, wherein the vibration sensors comprise piezoelectric devices.

51. A system as defined in claim 41, wherein the fluid nozzles comprise pulsating nozzles.

52. A system as defined in claim 41, wherein the controller is configured to indicate irregularities in a flow rate or a spray pattern being emitted by the nozzles.

53. A system as defined in claim 41, wherein the vibration sensors sense vibrations in the Z direction.

54. A system as defined in claim 41, wherein the vibration sensors sense vibrations in the Y direction.

55. A system as defined in claim 41, wherein the vibration sensors sense vibrations in the Z direction and in the Y direction.